physiologists, but, considered as a lecture experiment, it is very instructive.

6. *The Sensibility of the Telephone to Feeble Currents.*—As an example of this, I may instance the following experiment :—The gastrocnemius muscle of a frog was placed on the non-polarisable electrodes of Dubois Reymond, so that the transverse section touched the one electrode, and the longitudinal surface the other; the current thus obtained, when sent through a reflecting galvanometer, was sufficient to drive the spot of light from end to end of the scale, placed about three feet in front of the galvanometer; the galvanometer was then disconnected, and a telephone placed in circuit; it was then found that on making and breaking the current, a faint but sharp click of the telephone plate was heard. No click could be heard when the muscle was removed and the two electrodes were connected with a bit of moist blotting paper. The muscle current was therefore sufficient to act on the telephone. The click was stronger when the muscle was placed in contact with two platinum terminals, and when a small carbon microphone was also placed in circuit. I then tried to ascertain whether any effect on the click could be produced by throwing the muscle into a state of tetanus, and I found that in these circumstances no click could be heard at all. In other words, during the state of muscular contraction the muscle current was so diminished (the *negative variation* so called) as to be unable so to affect the telephone as to produce audible sounds. The telephone thus was used instead of the galvanometer in a physiological experiment.

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Physiological Laboratory,
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VOLCANIC PHENOMENA AND EARTHQUAKES DURING 1877

ALTHOUGH the most important results from the statistics of volcanic phenomena and earthquakes are obtained only if the observations and records spread over a period of many years, yet a number of interesting facts are revealed even in the compilation of the phenomena which occur during a single year. Prof. C. W. C. Fuchs is most indefatigable in these compilations, and he has recently published his statistical account of eruptions and earthquakes for the year 1877. From this we note the following details :—

During 1877 five important eruptions of different volcanoes took place. The eruption of the South American volcano Cotopaxi which lasted from June 25 to 28, was of a most characteristic nature for this mountain. According to the phenomena by which it was accompanied, it must be designated as an eruption of ashes and mud. Although Alexander von Humboldt's view, that the South American volcanoes do not produce lava, has been refuted long ago (Cotopaxi sent forth a copious stream of lava in 1853) yet the most frequent eruptions from this mountain are those of ashes only, without a flow of lava. Streams of mud are often combined with eruptions of this kind, and have different causes; in 1877 they particularly devastated the valleys of Chila and of Tumbaco, and in the former many hundreds of lives were lost through them. The ashes which the volcanos ejected so filled the air that complete darkness reigned everywhere, and the dust was so fine that it entered even into the interior of houses, although the doors and windows were shut.

The most violent eruption of 1877 occurred upon the island of Hawaii. Twice interrupted, the lava forced its way to the surface in three different places, and thus furnished the most undeniable proof that one and the same bed or hearth of lava, may produce eruptions in any of the numerous craters of Hawaii, according to time and circumstances. The first part of the eruption occurred on February 14 from a little side crater close to the summit of Mauna Loa; its duration was six hours, and the height of the column of smoke, which assumed the shape of an Italian pine-tree, was estimated at 5,000 metres. The second part occurred on February 24, in the Bay of Kalukeakua, well known as the place in which Cook, the great discoverer of the Sandwich Islands, was assassinated. This eruption was submarine, and lasted two days; its seat was in the middle of the bay, which is surrounded by numerous prehistoric records of its volcanic nature. On May 4 the lava found its usual way to the surface through the lava lake of Kilauea, which has solidified for some time. Here the wonderful phenomenon of high jets of lava occurred, a phenomenon which is peculiar to this spot only. During a period of six hours, now here, now there, vast jets liquid lava rose from the ground, and their number was so great that at one time more than fifty simultaneous ones were counted, some reaching an altitude of thirty metres.

The third eruption was that of the small Japanese island-volcano, Ooshima, and lasted from January 4 to February 6 or 7. Violent subterranean noise and disastrous earthquakes accompanied the volcanic phenomena, particularly on January 20 and on February 4 and 5.

On June 11 an eruption occurred in a volcanic district almost unknown hitherto, viz., near the Colorado River in Southern California, at some sixty miles' distance from Fort Yuma. The last eruption was a submarine one, and happened on June 15, near the Peruvian coast.

The number of earthquakes during 1877, of which Prof. Fuchs was able to obtain reliable accounts, amounts to 109, and he remarks that this is very nearly the average number per year, if compared to his annual compilations, which now extend over a period of thirteen years. They were distributed over the seasons of the year as follows :—

December, January, February	...	33 earthquakes.
March, April, May	...	31 ,,
June, July, August	...	11 ,,
September, October, November	...	34 ,,

On fifteen days several earthquakes occurred simultaneously in different places. Certain districts, such as Peru, Bolivia, Tokiô (Japan), the Island of Ooshima, Hawaii, &c., were visited by real earthquake periods, consisting of a large number of more or less violent shocks and detonations, while in others several earthquakes, separated by long periods of tranquillity, were observed. Among the latter we note—

Judenburg (Styria): January 4, December 27 and 28.
Western Odenwald: January 2 and 10.
Wald (Styria): January 12, September 5.
Rattenberg (Tyrol): April 8, October 11.
Bad Tüffer (Styria): April 4, 7, 24, 25, September 12.
Callao: April 22, May 14, October 9.
Western Switzerland: May 2, October 8, November 30.
Lisbon: November 1 and 4, December 22.

The earthquakes in Switzerland spread over a very considerable area. The first shocks on May 2 began near the Lake of Zürich and proceeded in three directions, viz., as far as Glarus and St. Gallen in the east, Mühlhausen in Alsace in the west, and the Black Forest in the north. They were followed by others more violent, and even more widely spread, on October 8. These were felt most severely at Geneva, where many chimneys were thrown to the ground; but they were distinctly noticed in the whole canton of Geneva, as well as in the Vaud, the Valais, Neufchatel, Berne, Freiburg, and Basel, and also in the French departments of Drôme, Isère, Rhone, Savois, Aix, Jura, Doubs, and even at Mühlhausen in Alsace. The extent of this earthquake towards the west was therefore a far more considerable one than towards the east, where the Alps seem to have hindered its progress; only in the broad Rhone Valley it was felt as far as Sitten. This is all the more remarkable since the Jura Mountains seem to have been without influence regarding its progress in the west. The greatest breadth of the area where the phenomenon was noticed, *i.e.* from Lyons to Sitten, measures some 200 kilometres, while its greatest length, *i.e.* from Valence to Mühlhausen, is 337 kilometres.

Another earthquake of large extension was the one felt on April 4 in the Eastern Alps; it was observed from Lower Styria as far as the junction of the Save with the Danube.

The most violent earthquake of all was the one which occurred on the South American coast on May 9, and in its whole course, as well as with regard to the minor phenomena which accompanied it, it can be compared only to the earthquake which occurred in the same region on August 13, 1868. We gave at the time details concerning this disastrous occurrence.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE

At the distribution of prizes at the Yorkshire College last Friday the reports were, on the whole, satisfactory, though the institution has yet much to struggle against. Its great want is want of funds, for, though it has had many generous givers, it takes a great deal of money to start an institution of such magnitude. The college, however, seems extending its influence,

and we think there can be no doubt of its ultimate complete success. The Marquis of Ripon spoke cheerfully both of the present and future of the college, and gave the students some excellent advice as to the aims they should set before them in pursuing their studies.

On the same day a similar ceremony was held at Owens College, Manchester, when much surprise was expressed that the Yorkshire College should oppose the Manchester University scheme. ¶ There need be no surprise at this, though we think that, if the two institutions thought of nothing but the educational welfare of the north of England, they would not find it so difficult to see eye to eye.

The Kirgis tribes of Siberia have contributed about 3,000*l.* to the university of Kasan, to serve as a fund for stipends for Kirgis students.

The continued existence of duels in the German universities is a sad blot on modern Teutonic civilisation. Within the past few weeks two deaths from pistol duels have occurred at the universities of Erlangen and Pest.

SCIENTIFIC SERIALS

Annalen der Physik und Chemie, Ergänzung Band viii. Stück 4.—In an inaugural dissertation, with which this number opens, Dr. Less investigates the heat conductivity of some seventeen varieties of stone, and several kinds of wood, his method being a refinement on that of Hopkins, with whose results (for stone) his own generally agree, only the numbers obtained for different varieties of one rock vary much more. In general, density and compactness favour the passage of heat, though the effect evidently does not depend on this alone. Stones of crystalline texture conduct better than those mechanically mixed, and fine-grained better than coarse-grained stones. In his table, marble from the Pyrenees is put at the top, its conductivity being reckoned 1,000; then follow Saxon granite (804), Carraran marble (769), &c., down to common clay (275). Tyndall's observation of a difference in conduction in two directions (with and at right angles to the fibres) in wood is confirmed, but the differences are found considerably less. The ratios of the galvanometer deflections are much greater in the better-conducting than in the worse-conducting woods, making it very probable that these deflections are proportional, not to the conductivities themselves, but to a somewhat higher power of them.—In two papers dealing with magnetic induction and Clausius and Weber's fundamental laws of electro-dynamics, M. Lorberg, by a development of the theory of two experiments, arrives at results throwing doubt on Clausius' law, and endeavours to show that Weber's is the only possible one.—M. Sadebeck contributes a lengthy paper on the crystallisation of markasite, and its regular growths with iron pyrites; and M. Schönn describes the absorption of light by water, petroleum, ammonia, alcohol, and glycerine.

Bulletin de l'Académie Royale de Belgique, No. 3, 1878.—In this number MM. Navez further describe their new system of telephony, by which they claim to speak at distances which are beyond the power of Bell's instruments, with an intensity equal to that of persons speaking face to face. The sender is a modified form of Edison's. A steel bar, supported in a tube, rests vertically on some rundles of retort carbon on the plate, which is copper covered with silver, and to which the sound of the voice passes through a tube of vulcanised caoutchouc attached below; bar and plate are of course in circuit, as also an induction coil. The plate is pinched between hardened caoutchouc and mahogany, which latter supports, on rundles of caoutchouc, a zinc disc with central tube for the steel bar.—Reviewing the geographical distribution of Balænopteræ, M. van Beneden shows that we cannot consider any of the four species of Balænopteræ and the one Megaptera, frequenting the North Atlantic, as proper to Europe. They all, or nearly all, visit the east coasts of North America, as well as the west coasts of Europe, and proceed, both eastwards and westwards, into the Pacific. The North Atlantic species have all representatives in the North Pacific, and *Rachianectes* alone has no representative beyond the Pacific.—Among other zoological papers M. Fraipont furnishes the second and third portions of his researches on the Acetinians of the Ostend coast (three of the forms described are new to science), and M. Longchamps makes additions to the synopsis of the Cordulinæ.—In an interesting memoir reported on by MM. van der Mensbrugghe and Folie, M. Lagrange concludes that a deformable mass, subjected to the attraction of another deformable mass, in rotation takes a motion of rotation in the same direction, which result he proposes to apply to explain the origin and establishment of astronomical movements.

Bulletin of the United States Geological and Geographical Survey of the Territories, vol. iv. No. 2, Washington, May, 1878, contains the following articles:—The geographical distribution of the mammalia considered in relation to the principal ontological regions of the earth and the laws that govern the distribution of animal life, by J. A. Allen.—Descriptions of new extinct vertebrata from the upper tertiary and Dakota formations, by E. D. Cope (describes a large number of new reptile, bird, and mammalian forms).—Notes on a collection of fishes from the Rio Grande at Brownesville, Texas, and a catalogue of the freshwater fishes of North America, by Dr. D. Jordan.—Description of a fossil passerine bird from the insect-bearing shales of Colorado, by J. A. Allen, with a plate.—The coleoptera of the Alpine regions of the Rocky Mountains, by Dr. J. L. Le Conte.—On the orthoptera of Dakota and Montana, by Prof. Cy. Thomas.—On the hemiptera of the same, by P. R. Uhler.—On the lepidoptera of Montana, by W. H. Edwards.—On some insects of unusual interest from the tertiary rocks of Colorado and Wyoming, by S. H. Scudder.

Schriften der physikalisch ökonomischen Gesellschaft zu Königsberg (1876, Nos. 1 and 2, and 1877, No. 1).—These parts, besides a large number of smaller papers and notes, contain the following more important treatises:—On the flora of the great Werder, near Marienberg, by I. Preuschoff.—Report on the recent excavations at Tengen, near Brandenburg (Natangen), by R. Klebs.—On the mechanical principle of equal temperatures in the bodies of the higher animals, by Dr. A. Adamkiewicz.—On some remains of extinct buffalo species from the province of Prussia, by Dr. Jentzsch.—On the decrease in the quantity of water in the rivers of cultivated countries, by Dr. Krosta.—On archæological museums, by O. Tischler.—On some physical relations between the human and animal organism and anorganic nature, by Prof. Grünhagen.—On the latest improvements in the photographic pigment printing process, by Dr. Benecke.—On some antiquities from Claussen, by Dr. Jentzsch.—On the latest discoveries in the diluvial fauna of East Prussia, by the same.—On the strata containing amber in the so-called Samland, by Herr Marcinowski.—On the formation of amber, by Dr. Jentzsch.—On the geognostical investigation of the province of Prussia during the year 1876, by the same.—On the *Macro-lepidoptera* of the province of Prussia, by Rob. Grentzenberg.—On the distribution of rain over the year 1876, by Dr. Schiefferdecker.—On truffles, by Dr. Caspary.—On the great Indian census of 1872, by Dr. Wagner.—Speech in memory of the late Dr. K. E. von Baer, by Prof. Zaddach.—On a naval chart from the fourteenth century, by Dr. Jentzsch.—Full reports of the meetings of the Prussian Botanical Society of Königsberg.—Craniological researches, by Dr. Kupffer.—On a map of the world dating from the year 1452, by Dr. Jentzsch.—On the retina purple, by Dr. von Wittich.—New researches on the habits of ants, Dr. Gwalina.

SOCIETIES AND ACADEMIES

LONDON

Royal Society, May 16.—"On the Variations of the Diurnal Range of the Magnetic Declination as Recorded at the Prague Observatory," by Balfour Stewart, LL.D., F.R.S., Professor of Natural Philosophy at Owens College, Manchester.

The Prague observations began in July, 1839, and have been continued until the present date. They have been dealt with in the same way as those of Kew and Trevandrum. In the first place a set of nine-monthly values of declination range has been obtained corresponding to similar nine-monthly values of spotted solar area. When these are graphically plotted it is found that a number of points in the sun-spot curves may be fairly identified as corresponding to certain points in the declination-range curve, but that the latter invariably lag behind the former in time.

This will be seen from the following table, in which the epochs of maximum and minimum sun-spots are compared with those of declination-range:—